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1.	Your reference	MJD/57907/000
		09JAN02 E686261-2 D02882 P01/7700 0.00-0200325.9
2.	Patent application number *(The Patent Office will fill in this part)*	**0200325.9**
3.	Full name, address and postcode of the or of each applicant *(underline all surnames)*	**KEYMED (MEDICAL & INDUSTRIAL EQUIPMENT) LTD** **KEYMED HOUSE** **STOCK ROAD** **SOUTHEND-ON-SEA** **ESSEX** **SS2 5QH** 548693001
	Patents ADP number *(if you know it)*	
	If the applicant is a corporate body, give the country/state of its incorporation	**UNITED KINGDOM**
4.	Title of the invention	**A DUMMY MEDICAL INSTRUMENT FOR USE IN A SIMULATOR**
5.	Name of your agent *(if you have one)*	**BOULT WADE TENNANT**
	"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*	**VERULAM GARDENS** **70 GRAY'S INN ROAD** **LONDON WC1X 8BT**
	Patents ADP number *(if you know it)*	**42001** ✓

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8.	Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:* *a) any applicant named in part 3 is not an inventor, or* *b) there is an inventor who is not named as an applicant, or* *c) any named applicant is a corporate body.* *See note (d))*	**YES**

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Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	1
Any other documents *(Please specify)*	

1 I/We request the grant of a patent on the basis of this application.

Signature: Bailey Wade Sharp — Date: 8 January 2002

2. Name and daytime telephone number of person to contact in the United Kingdom: **MARTYN DRAPER 020 7430 7500**

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A DUMMY MEDICAL INSTRUMENT FOR USE IN A SIMULATOR

The present invention relates to a dummy medical instrument for use in a simulator.

One type of simulator to which the present invention is applicable is that disclosed in GB A 2252656. This simulator simulates the operation of an endoscopic process. A dummy endoscope is insertable into a fixture which is provided with a sensor mechanism to sense the longitudinal and rotational movement of the dummy endoscope. This information is fed to a controller which generates force feedback information based on virtual model data held in the computer memory. The force feedback applied to the dummy endoscope is synchronised with a visual representation of the procedure so as to provide a realistic simulation providing a useful training tool to endoscope users.

With an instrument such as an endoscope, the tip of the endoscope is manipulated by angulation control in the form of one or more control knobs on the handle of the endoscope which are linked to cables which extend down the insertion tube of the endoscope. Turning of the control knobs produces a corresponding movement of the cable and hence the tip. An endoscope can have two control knobs one of which controls the left/right movement of the tip and the other of which controls the up/down movement of the tip.

In any simulator, it is desirable to use as much of the real instrument as possible in order to provide the most realistic simulation. Thus, it is important to use the same controls and cable as used on the original instrument. In order to provide force

feedback to the angulation control, it is necessary to reroute each cable which in the normal endoscope extends from one side of the control knob to the tip of the endoscope. Each cable must be instead turned back on itself and rerouted down the umbilical to the force feedback unit. In the force feedback unit, the cable is connected to a motor, the torque of which is controlled to provide a proportional force feedback to the angulation control based on the virtual sensed position of the tip of the endoscope in relation to the simulation data.

Within the constraints of the normal instrument, there is very little space available to turn the cable back on itself so that it is difficult to avoid generating undesirable friction which can distort the force feedback and cause premature wear of the cable.

According to the present invention a dummy medical instrument for use in a simulator comprises a central body with user manipulatable angulation control, an insertion tube and an umbilical extending from the control body, wherein in a real instrument corresponding to the one being simulated, at least one angulation cable would extend from the user manipulatable controls to the tip of the insertion tubes such that movement of the angulation control changes the angulation of the tip, and wherein in the dummy medical instrument the angulation cable extends from the user manipulatable angulation control, around a pulley where it is turned through substantially 180°, and down the umbilical.

The use of the pulley eliminates sliding friction on the cable where it is turned back on itself. This provides not only smoother operation of the force feedback system, but also reduces the wear on the

cable.

Preferably, the angulation cable is a co-axial cable in which a central wire is moveable within a sleeve. The sleeve is preferably removed for the portion of the cable surrounding the pulley, such that the wire engages directly with the pulley.

When more than one angulation cable is used, each cable should be provided with its own pulley system. In one particularly advantageous arrangement, a first cable is wrapped around a single pulley, while a second cable is wrapped around a pair of pulleys which are spaced apart so that the second cable forms a loop outside of the loop formed by the first cable.

In order to retain the cable on the pulley, the or each pulley preferably has a convex periphery, and at least a part of the periphery of the pulley is provided adjacent to the facing wall of a pulley housing.

An example of a dummy medical instrument constructed in accordance with the present invention will now be described with reference to the accompanying drawings, in which:

Fig. 1 is a plan view of the angulation system; and

Fig. 2 is a schematic perspective view showing the arrangement of pulleys, cables and angulation control.

The particular medical instrument being described here is an endoscope. However, it may be any medical instrument where cables which are normally manipulated to move a part of the instrument have to be rerouted

so that force feedback can be applied to the cable.

The described arrangement is adapted from a conventional endoscope control body. Both of the real and dummy endoscopes have an insertion portion leading from the control body ending at the endoscope tip. In the real instrument, this tip is manipulated to steer it through the colon. An umbilical is provided in both the real and dummy endoscopes leading from the control body to feed various cables to the control body.

The control body is provided with a pair of co-axial rotatable knobs 1,2 as shown in Fig. 2. The outer knob 1, in this case, would, in a normal endoscope, be rotated to move the tip in an up/down direction, while the inner knob 2 would move the tip in a left/right direction orthogonal to the up/down direction. These described directions are only notional directions as, in use, the endoscope may be used in any orientation. Wrapped around each pulley is a wire chain drive 3,4 to each of which a cable is attached. In the illustrated example there are four cables which, for convenience, are denoted up cable 5, down cable 6, left cable 7 and right cable 8.

In a normal instrument, these cables 5,6,7,8 would extend all the way to the tip of the endoscope to provide the tip movement referred to above upon rotation of the knobs 1,2.

In the dummy instrument, these cables must be rerouted along the umbilical of the instrument which directs them to an angulation feedback controller. In the angulation feedback controller, the up/down cables 5,6 are connected to opposite sides of a force feedback motor and the left/right cable 7,8 are

connected to a similar motor.

Rotation of the knobs 1,2 is detected and a system controller interprets this information together with information on the longitudinal and rotational positions of the tip of the endoscope. Using data representing a simulated model of a colon, software detects when the simulated tip of the endoscope comes into contact with the simulated colon wall. At this time, the controller sends a force feedback signal to the two feedback motors which hence provides a resistance to the movement of the cables 5-8 which is felt at the knobs 1,2 as a resistance to turning.

In order to route each cable into the umbilical 9, the arrangement shown in Fig. 1 and 2 is employed. Fig. 1 shows the rerouting of two of the cables, namely the down cable 6 and the right cable 8. A similar arrangement is provided on the opposite side of the control body as shown in Fig. 2. However, as this has the same construction and operation as the down/right configuration shown in Fig. 1, only this configuration is described in detail. The right cable 8 is connected to the chain 4 that surrounds the inner knob 2. This cable then extends around a first pulley 10 rotatably mounted on a housing 11 within the control body. The pulley 10 turns the right cable through 180°. A sheath 12 is connected to the housing 11. The cable 8 enters the sheath 12 at this point and is guided within this sheath into the umbilical which leads it to the feedback motor.

The down cable 6 passes in a loop outside the right cable 8 around a pair of spaced pulleys 13,14 rotatably mounted on the housing 11. The down cable 6 enters a sheath 15 attached to the housing 11 at connector 16 and is also guided into the umbilical to

the other force feedback motor as described with reference to the right cable.

CLAIMS

1. A dummy medical instrument for use in a simulator, the instrument comprising a control body with user manipulatable angulation control, an insertion tube and an umbilical extending from the control body, wherein in a real instrument corresponding to the one being simulated, at least one angulation cable would extend from the user manipulatable controls to the tip of the insertion tubes such that movement of the angulation control changes the angulation of the tip, and wherein in the dummy medical instrument the angulation cable extends from the user manipulatable angulation control, around a pulley where it is turned through substantially 180°, and down the umbilical.

2. An instrument according to claim 1, wherein the angulation cable is a co-axial cable in which a central wire is moveable within a sleeve.

3. An instrument according to claim 2, wherein the sleeve is removed for the portion of the cable surrounding the pulley, such that the wire engages directly with the pulley.

4. An instrument according to any one of the preceding claims, wherein more than one cable is provided, and each cable has its own pulley system.

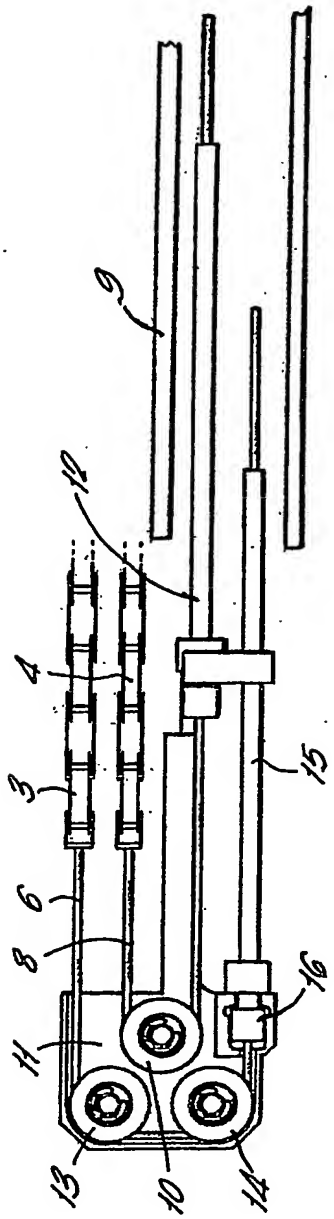
5. An instrument according to claim 4, wherein a first cable is wrapped around a single pulley, while a second cable is wrapped around a pair of pulleys which are spaced apart so that the second cable forms a loop outside of the loop formed by the first cable.

6. An instrument according to any one of the

preceding claims, wherein the or each pulley preferably has a convex periphery, and at least a part of the periphery of the pulley is provided adjacent to the facing wall of a pulley housing.

: 315216: MJD: VAM: LONDOCS

FIG. 1.



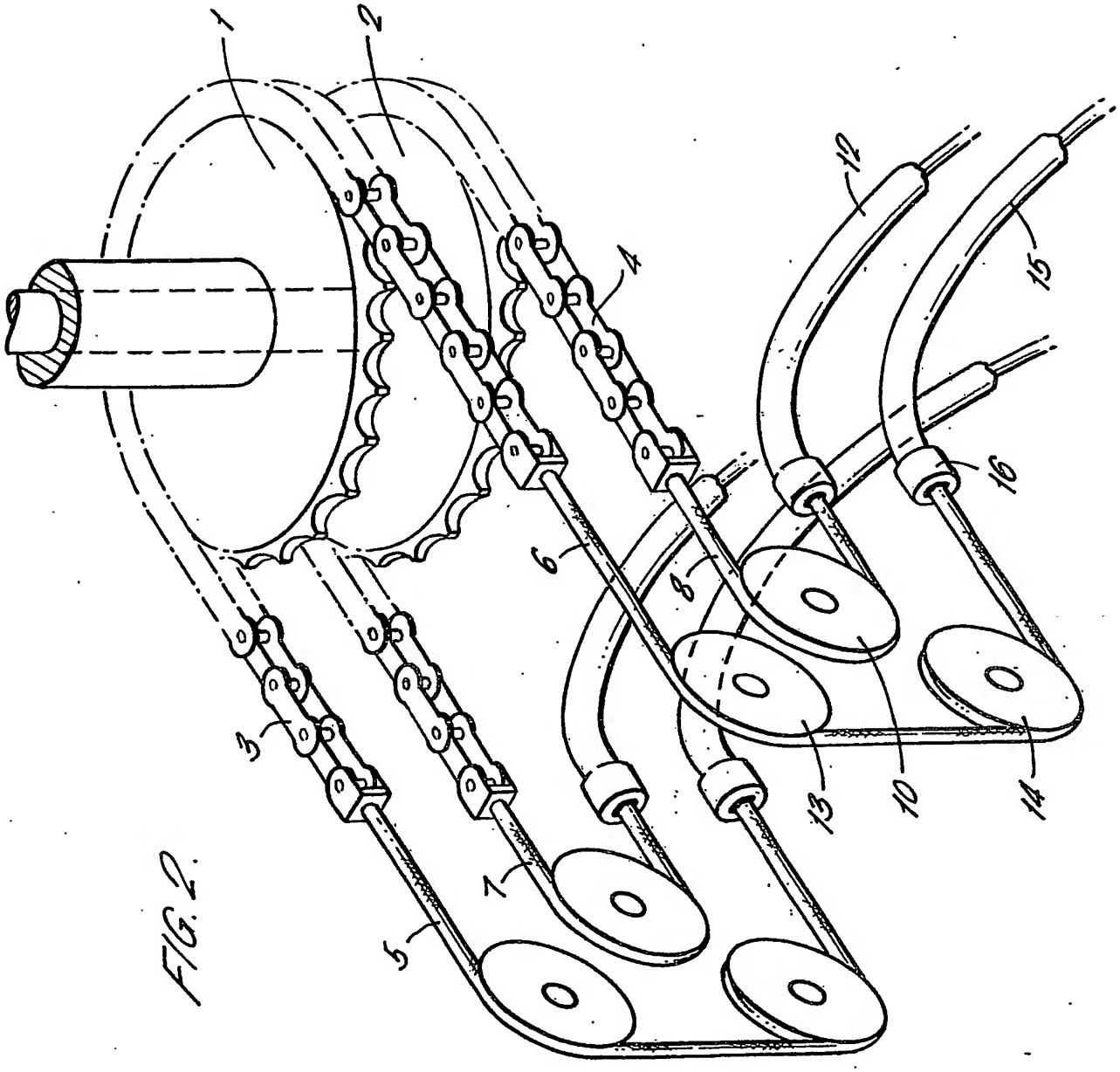


FIG. 2